noxious vapours given off during putrefaction, contain the N, S, and Ph of the animal substance, and that these elements are not liberated in the simple form of ammonia, and sulphuretted and phosphuretted hydrogen. I also remarked during this investigation, that, as putrefaction proceeds, different volatile bodies are given off.

Before concluding, I may add, that when the platinum salts are heated in small test-tubes, they give off vapours, some acid and some alkaline, possessing a most obnoxious and sickening odour, very like the odours of putrefaction; and that at the same time a white crystalline sublimate, which is not chloride of ammonium, is formed.

As I foresee that these researches will occupy several years, I have deemed it my duty in the mean time to lay the above facts before the Society.

March 1, 1860.

Sir BENJAMIN C. BRODIE, Bart., President, in the Chair.

In accordance with the Statutes, the Secretary read the following list of Candidates for election into the Society:—

Frederick Augustus Abel, Esq.
Somerville Scott Alison, M.D.
Alexander Armstrong, M.D.
Thomas Baring, Esq.
Charles Spence Bate, Esq.
John Frederic Bateman, Esq.
Henry Foster Baxter, Esq.
William Brinton, M.D.
Edward Brown-Séquard, Esq.
Thomas William Burr, Esq.
Richard Christopher Carrington, Esq.
Alexander Ross Clarke, Capt. R.E.
William White Cooper, Esq.
Joseph Cubitt, Esq.
Henry Duncan Preston Cunningham, Esq., R.N.
Thomas Rowe Edmonds, Esq.
James Fergusson, Esq.
Francis Galton, Esq.
Joseph Henry Gilbert, Ph.D.
Robert Philips Greg, Esq.
John Braxton Hicks, M.D.
Sir William Jardine, Bart.
Thomas Hewitt Key, M.A.
Waller Augustus Lewis, Esq.
Joseph Lister, Esq.
Edward Joseph Lowe, Esq.
David Macloughlin, M.D.

Rev. Robert Main, M.A.
Gavin Milroy, M.D.
Rev. Walter Mitchell.
Ferdinand Mueller, M.D.
Robert William Mylne, Esq.
William Newmarch, Esq.
Andrew Noble, Capt. R.A.
Roundell Palmer, Esq., Q.C.
Edmund Alexander Parkes, M.D.
George Peacock, Esq.
John Thomas Quekett, Esq.
Rev. Thomas Robinson, D.D.
Maxwell Simpson, Esq.
Edward Smith, M.D.
Sir James Emerson Tennent.
Henry Ward, Capt. R.E.
J. Forbes Watson, M.D.
C. Greville Williams, Esq.
Frederick Marow Eardley Wilmot, Lieut.-Col. R.A.
Matthew Digby Wyatt, Esq.

The following communications were read:—

1. "On the Electrical Phenomena which accompany Muscular Contraction." By Professor C. MATTEUCCI. Communicated by Dr. SHARPEY, Sec. R.S. Received January 7, 1860.

Dr. Radcliffe has recently communicated to the Royal Society some observations on the nature of the electrical phenomena accompanying muscular contraction. It is known that M. du Bois-Reymond admits that the muscular current diminishes during contraction, and that he attributes the phenomena indicated by the galvanometer to the momentary predominance of currents due to the polarization of the electrodes of platinum over the muscular current. In my last memoir on Electro-physiology, which was communicated to the Royal Society and appeared in the Philosophical Transactions for 1856, I proved that these phenomena take place independently of the existence of secondary currents of the electrodes, and I hence concluded, at least as regards the muscles of frogs, that during contraction there is a current, or rather an instantaneous electrical discharge, which takes a contrary direction to that of the *relaxed gastrocnemius*, and in general to that of the current which is found on applying the extremities of the galvanometer to the extremities of the limbs of a frog.

In order to avoid the influence of secondary polarity, M. du Bois-Reymond, and after him several other German physiologists, have

thought it expedient to contract and tetanize the gastrocnemius before closing the circuit of the galvanometer; the deviation thus obtained is feebler than that which is due to the current of a muscle in repose, but never in a contrary direction to that due to this current.

I have already remarked* that this result accords with that which is obtained by the ordinary experiment, in which the muscular current is in circulation previously to the contraction of the muscle. In fact, we know that by continuing to keep the muscle in contraction, above all when the muscle remains tetanized, the electric phenomenon accompanying contraction (the effect of which is to produce a deviation of the needle in a contrary direction to that of the current of a relaxed muscle) becomes gradually less intense as the contractions are more and more feeble.

The method employed by Dr. Radcliffe is the same as that which I followed in my latest experiments; that is, he made use of amalgamized plates of pure zinc as electrodes, immersed in a neutral solution of sulphate of zinc, and after having ascertained that there was nothing to fear from the effects of secondary polarity, he says that he finds that the needle deviated by the muscular current descends, during contraction, towards zero, but *only more slowly* than it would have done had the circuit been opened.

Dr. Radcliffe next examines another of my experiments, in which, instead of placing a *gastrocnemius* in the circuit, I employ a thigh cut transversely at the upper extremity, so that the needle remains deviated in a contrary direction to that of the gastrocnemius. In this arrangement of the experiment, when contraction is produced, the deviation of the needle increases, which is perfectly in accordance with the idea that during contraction a muscular current is developed in a contrary direction to the current of the relaxed gastrocnemius. Dr. Radcliffe attempts to explain this result by supposing (if I rightly understand his idea) that during contraction the contacts with the electrodes are deranged so as to facilitate the passage of the current of the relaxed muscle.

Being unwilling to remain in doubt as to the nature of the electrical phenomena of muscular contraction, I have of late repeated and varied my experiments.

* Nuovo Cimento, September 1858, p. 238.

As to Dr. Radcliffe's first remark, I shall only observe that in the principal experiment the needle does not merely move slowly towards zero during contraction, but is seen, during the first contractions, especially when the frog operated on is vivacious, to move rapidly down to zero, to oscillate, to pass to the opposite side, and sometimes even to remain fixed, while thus deviated, for a very short interval of time. This result, which is easily obtained and can be verified without difficulty, is the same, whether the electrodes are of platinum, like those employed by M. du Bois-Reymond, or of zinc.

It is easy to understand that, in order to succeed in these experiments, it is desirable that the needle should be as little deviated as possible before the contractions: this object is best ensured in the following way:—I prepare the frog by reducing it to two thighs, leaving a single lumbar nerve in order to obtain contractions in one of the thighs. Instead of saturated solution of sulphate of zinc, I employed a weak solution of this salt, in order to avoid any alteration of the surface of the muscles; and finally, in order to maintain exactly the same points of contact between the two electrodes and the two near points of the middle portion of the thigh, I employ two fine woollen cords or two thin strips of card-board fixed with sealing-wax on a plate of glass and soaked in the same solution. The experiment is made by applying the glass plate with a certain pressure on the thigh, so that the two cords on one side touch the thigh, and on the other are placed in contact with the cushions of flannel or card-board which are immersed together with the electrodes, according to the method followed by M. du Bois-Reymond.

I think it useful to describe in a few words a little apparatus which affords a good deal of facility for making these experiments. It consists in a small square block of wood, with a cavity deep enough to receive the electrodes and the cushions. It is hardly necessary to say that this cavity is coated with a varnish of sealing-wax and divided in the middle by a glass plate. Another cavity in the same block serves as a recipient for the two thighs; the sciatic nerve extends beyond the block, and rests on two platinum wires which communicate with the pile or with the electro-magnetic machine. The communication between the thigh and the electrodes is established by means of the glass plate in the manner above de-

scribed, that is, I press this strip of glass slightly on the middle of the thigh on one side, and at the same time the extremities of the two woollen cords come to rest on the cushions. The movements of the needle are observed through a telescope (lunette). I have repeated this experiment thirty or forty times. Sometimes, and this case is the most frequent, the first deviation produced by the muscle in repose is directed in the same sense as that of the current of the gastrocnemius; sometimes the current is null, or almost null; sometimes, and this case is the most rare, the deviation is in a contrary direction, and this occurs most frequently in operating on the hinder portion of the thigh.

In all these experiments, the moment that the thigh begins to contract, the needle moves in a constant direction; the deviation which intervenes is greater or less according to the force of the contraction, and indicates constantly a descending discharge or current of extremely short duration, which traverses the thigh in the direction of the ramification of the nerves, and in a contrary direction to the current of the gastrocnemius.

II. "An Inquiry into the Muscular Movements resulting from the action of a Galvanic Current upon Nerve." By Charles Bland Radcliffe, M.D., F.R.C.P., Physician to the Westminster Hospital. Communicated by Dr. Sharpey, Sec. R.S. Received February 2, 1860.

(Abstract.)

In a lecture delivered about two years ago*, in which he treats among other things of the muscular movements resulting from the action of a galvanic current upon a motor or mixed nerve, Professor Claude Bernard says that some of the more important of these movements have been overlooked, and he quotes an account of some investigations by Dr. Rousseau of Vezy, which do away with certain very perplexing variations in the order of these movements.

The movements resulting from the action of a galvanic current upon nerve are usually divided into the three periods of double, alternate, and single contraction which are set down in the following Table:—

* Leçons sur la Physiologie et Pathologie du système nerveux. Tome i. Leçon 10. Paris, 1858.